

CLAIMS:

1. A method of making a photodetector circuit incorporating a photodiode, the method including the steps of providing a first electrically insulating layer on a semiconductor substrate, forming a first window in the first insulating layer exposing an area of the substrate within the first window, forming a guard ring in the exposed area of the substrate within the first window, providing a second electrically insulating layer covering the exposed area of the substrate within the first window, forming a second window in the second insulating layer exposing a selected area of the substrate within the first window, and growing on the selected area of the substrate exposed by the second window an epitaxial layer providing an active region of the photodiode detector such that the edges of the epitaxial layer are spaced from the inner periphery of the first window.
2. A method according to claim 1, wherein the extent of the windows is such that the guard ring is overlapped by the edges of the epitaxial layer.
3. A method according to claim 1 or 2, wherein the second window is formed in the second insulating layer so as to leave a portion of the second insulating layer within the inner periphery of the first window which ensures, during growth of the epitaxial layer, that the edges of the epitaxial layer are spaced from the inner periphery of the first window.
4. A method according to claim 3, wherein the remaining annular portion of the second insulating layer is removed by a wet oxide etch.
5. A method according to any preceding claim, wherein a further electrically insulating layer is provided on the first insulating layer covering the first window, and a further window is formed in the further insulating layer to expose a selected area of the substrate within the first window prior to the forming of the second insulating layer covering the exposed area of the substrate within the first window.

6. A method according to claim 5, wherein the second insulating layer is substantially thinner than the further insulating layer.
7. A method according to claim 5, wherein the second insulating layer has a thickness of 10 nm to 50 nm, and preferably about 25 nm.
8. A method according to any preceding claim, which includes the step of growing on top of the first-mentioned epitaxial layer a further epitaxial layer having a higher doping level than the first-mentioned epitaxial layer.
9. A method according to claim 8, wherein the further epitaxial layer contacts the substrate so as to be in ohmic contact with the guard ring in the substrate.
10. A method according to any preceding claim, wherein the photodiode detector is an avalanche photodiode.
11. A method according to any preceding claim, wherein readout circuitry is formed on the first insulating layer.
12. A photodetector circuit including a photodiode, the circuit comprising a semiconductor substrate, a first electrically insulating layer on the substrate, a first window in the first insulating layer, a guard ring in the substrate within the first window, a second electrically insulating layer on the first insulating layer, a second window in the second insulating layer within the first window, and an epitaxial layer on the substrate forming an active region of the photodiode, the epitaxial layer being located within the second window such that the edges of the epitaxial layer are spaced from the inner periphery of the first window.
13. A photodetector circuit according to claim 12, wherein the photodiode is an avalanche photodiode.

14. A photodetector circuit according to claim 12 or 13, wherein the guard ring is overlapped by the edges of the epitaxial layer.
15. A photodetector circuit according to claim 12, 13 or 14, wherein a further epitaxial layer having a higher doping level than the first-mentioned epitaxial layer is provided on top of the first-mentioned epitaxial layer.
16. A photodetector circuit according to claim 15, wherein the further epitaxial layer constitutes a contact layer overlapping the second insulating layer.
17. A photodetector circuit according to claim 15 or 16, wherein the further epitaxial layer is in ohmic contact with the guard ring in the substrate.
18. A photodetector circuit according to claim 15, 16 or 17, wherein a metal contact is provided on the further epitaxial layer.
19. A photodetector circuit according to any one of claims 12 to 18, wherein the insulating layers are made of silicon dioxide.
20. A photodetector circuit according to any one of claims 12 to 19, wherein the or each epitaxial layer is made of silicon.
21. A photodetector circuit according to any one of claims 12 to 20, wherein readout circuitry is formed on the first insulating layer.
22. An array of photodetector circuits according to any one of claims 12 to 21.
23. A photodetector circuit substantially as hereinbefore described with reference to the accompanying drawings.
24. A method of making a photodiode, substantially as hereinbefore described with reference to the accompanying drawings.